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ART. V. — ENGLISH ARCTIC EXPEDITION.

WHEN it was announced that the English government, which had for years left the matter of Arctic exploration to the Germans, Scandinavians, Austrians, Russians, and Americans, was about to send out an expedition, the greatest interest was awakened, as it was a field in which the English had been particularly distinguished. They had been identified with Arctic exploration since the days of Queen Elizabeth. In the search for Sir John Franklin they had explored a large part of the Polar area; the most extensive sledge-journeys had been made by them; and as several of their most able Arctic commanders were still living to advise with, it was universally felt that an expedition would now be despatched which in the completeness of its equipment and the character of its officers and men would be unsurpassed by any expedition that had ever been sent into the Arctic seas.

This expectation was fulfilled. The British government, with a most commendable liberality in expenditure, bringing to its aid everything which science or past experience could suggest, fitted out two steam-vessels, the *Alert* and the *Discovery*, and, that nothing might be wanting in the management of an expedition, the object of which was geographical exploration and the acquisition of scientific knowledge, an experienced Arctic explorer, Captain, now Sir George Nares, was recalled from the command of the scientific expedition of the *Challenger*, and put at the head of this new expedition for Polar research and discovery.

How fully the government had performed its part will appear by quoting Sir George Nares's language, publicly uttered before his departure. "No similar expedition," he said, "has ever quitted the shores of this or of any other country as fully prepared as we are"; adding, "Now that England has resolved to take part in these enterprises, success is certain." Nor was this expectation confined to England. The venerable geographer, M. Vivien de Saint Martin, when referring in his "*Année Géographique*" to the expedition, said: "In its organization, so distinguished by foresight and prudence, no less than by the scientific acquirements and practical ability of the officers who are to conduct it, this expedition is one that justifies our indulging in the very highest hopes.

This time, at last, a European flag will perhaps float over the Pole."

The expedition was directed to continue two years; to attempt to gain the highest northern latitude, and, if possible, to reach the Pole. It returned in one year; and when the telegraphic despatch from Sir George Nares appeared, "Pole impracticable, no land to the north, expedition otherwise successful," there was a general feeling of disappointment. It was felt that an expedition from which so much had been anticipated had failed to accomplish its object, and the desire was wide-spread for more particular information.

We have now all the essential details in an elaborate report by Sir George Nares, which, with other communications on the part of individual officers that have appeared, enables us to review the voyage and its results. The vessels reached Upernavik* in Baffin's Bay, the farthest northern settlement, in July, 1875, and from thence, being steamers, they forced their way through the middle ice of Baffin's Bay, a passage generally dreaded by mariners, getting through it to Cape York, and in five days after leaving Upernavik both vessels anchored in Port Foulk, in Smith's Channel, at the entrance to Smith's Sound, the best-known station for winter-quarters, and, as Sir George Nares calls it, "the elysium of the Arctic region." From Port Foulk they crossed the channel to the westward, reaching Cape Sabine, which lies at the entrance of Smith Sound, and from thence through the Sound, they had a long and continued struggle with heavy ice-floes, demanding incessant watchfulness and the most skilful seamanship. Sir George Nares was in the crow's-nest literally day and night during this perilous passage. Off Cape Victoria both vessels were run into the pack, with the expectation of steaming their way through it, but became hopelessly beset, and were in imminent peril by the rapid advance of an iceberg towards the floes to which they were attached, the advancing mass tearing its way through the surface ice, so that preparations had at once to be made for a severe nip by unshipping the rudder and screw of each vessel, and the Alert narrowly escaped being crushed to pieces. Whilst Hall, in the *Polaris*, sailed almost without obstruction up to 82° 16' N. lat., they were

* In the prefixed Circumpolar Map of the Arctic the places referred to in the article, the positions where the vessels wintered, and the discoveries made, will be found.

twenty-five days in making their way along the west side of Smith Sound from Cape Sabine to Discovery Bay, a distance only of about two hundred and fifty miles ; both vessels, to use the language of Sir George Nares, "dodging about as best they could, taking advantage of every change in their favor," the Discovery, as well as the Alert, having several hair-breadth escapes. "The constant movement," says Sir George, "of heavy ice-floes nipping together with great force, like the closing of a gigantic pair of scissors, between which, if once caught, our vessels would have been instantly crushed, kept us in constant anxiety and necessitated incessant watchfulness and labor on the part of both officers and crew."

Without pursuing further the details of this arduous passage, it will be sufficient to say that upon reaching Lady Franklin Sound they found upon its northern shore a well-protected harbor for the Discovery, where she remained until the return of the expedition ; whilst the Alert, seizing a favorable opportunity, proceeded onward to Cape Union, the farthest northern point seen by Dr. Hayes, in 1866, and succeeded, by the 1st of September, in getting around the northeast coast of Grant Land to $82^{\circ} 27' N.$ lat., the farthest point ever reached by a vessel. Here a view was had from an elevation of three hundred feet ; and it was found that President Land, which was supposed to have been seen from the Polaris, trending poleward, does not exist, nor was any land to be seen to the north ; "but," says Sir George, "we had arrived on the *shores of the Arctic Ocean*, finding it exactly opposite to an open Polar Sea." It being impossible to get any farther, the only alternative was adopted of securing the vessel behind a protecting barrier of ice, where, though thoroughly embayed by the pack, she was fairly protected ; for the heavy ice outside of her grounded in twelve fathoms, and she remained there securely until the return of the expedition.

During the autumn sledge-journeys from the Alert were made along the coast of Grant Land to the westward as high as $82^{\circ} 44' N.$ lat. The broken masses of ice pressed up against the coast were in some places thirty feet high, and the snow-drifts in the valleys rendered the travelling very slow and difficult. The fall of snow was so enormous that the men had to draw their sledges through it up to their knees, and frequently up to their waists. On four occasions the sledges, with their cargoes, broke through the ice ;

the men fell through it frequently, and out of a party of twenty-one, eight were severely frost-bitten and three suffered amputation.

In October an attempt was made by a sledge-party to communicate with the *Discovery*, but it was without success. A long Arctic winter then followed, with an unparalleled duration of darkness for one hundred and forty-two days, during which the severest cold yet known was experienced. In the *Alert*, in March, it was as low as 73° below zero, and in the *Discovery*, at the same time, it reached 70° below zero.

The winter was not one of idleness. Notwithstanding the intensity of the cold, magnetic, meteorological, and other scientific observations were kept up, an observatory having been erected upon the shore; a school for the instruction of the less educated of the men was regularly held; scientific lectures and theatrical entertainments were given, in which both officers and men participated; and by these means, with the daily routine of duties and the excellent discipline that was maintained, the depressing effect of being deprived of the light and heat of the sun for nearly five months was averted, and this period was passed with "much cheerfulness and contentment."

On the 12th of March a sledge-party was again despatched to communicate with the *Discovery*, but was compelled to return, as one of the number, Christian Peterson, the well-known Danish interpreter of many previous expeditions, became so exhausted that nothing could keep him warm. He was badly frost-bitten in the feet, both of which had to be amputated, and he died a few months afterwards. This journey was resumed, and after an arduous effort the *Discovery* was reached on the 26th of March. Her crew had passed a comparatively comfortable winter, and whilst the region around the *Alert* was almost barren of animal life, they had succeeded, in the *Discovery*, in obtaining thirty-six musk-oxen.

In April several sledge-parties started for exploration, — one from the *Alert* in the direction of the Pole, under Commander Markham; one from the same vessel under Commander Aldrich, to explore the coast of Grant Land to the northward and westward; and one from the *Discovery*, to explore the northwest and northern shores of Greenland, under Commander Beaumont; with many minor expeditions from both vessels.

In Commander Markham's expedition across the Polar Sea north, in the direction of the Pole, the men had not only to draw their sledges, but two heavy boats, fifteen and twenty feet long, over rugged floes of ice, separated by ridges sometimes thirty feet high, — to make their way over the débris of the pack ice broken up by the previous summer, and refrozen during the winter into chaotic rugged masses of angular blocks, from forty to fifty feet high, and of every possible shape. They had frequently to cut their way with picks through great hummocks; and such were the contortions and checks that they had frequently to go five times over the same ground, so that, in making a distance of seventy-three miles towards the Pole, they actually travelled over two hundred and seventy-six miles. Each man had to drag two hundred and thirty-six pounds, and to work from ten to twelve hours a day, and as they could pull but a few feet at a time, they were able to make but from one mile and a quarter to two miles and three quarters a day. They were absent on this expedition, engaged in this incessant labor, for two months and a half; and to add to their trials, the scurvy broke out amongst them, so that, when relief reached them, out of seventeen of the party, only five were able to drag the sledges. They succeeded in getting to 83° 20' 26" N. lat., — the farthest northern point ever reached by man, or about four hundred miles from the Pole.

The outbreak of the scurvy, and the fact that, in consequence of the slowness of their progress, they had reached the utmost limit of their provisions, made their return indispensable. Had it been possible even then to have extended their journey, and had the ice, upon their return, broken up as the summer approached, it may be doubted if they would ever have reached the vessel, hampered as they were with boats. In the return of the Austrian expedition in sledges and boats, with the aid of dogs, during the months of May, June, and July, 1874, they found, after *two months* of incessant labor, that the distance between them and their abandoned ship was only *two German miles*; a fact which will impress the reader with the great difference between sledging over land or along the line of a coast, and attempting to penetrate the Polar Ocean, where, for safety, boats must be taken.

Commander Beaumont's sledge-party along the north coast of Greenland were beset with like difficulties. Enormous blocks of

polar ice had been pressed against the shore, making the travelling a matter of incessant labor, so that seven days were occupied in moving only twenty miles. The scurvy also broke out with them; and when they came in, three only — Commander Beaumont, the quartermaster, and another — were able to draw the sledges. The western sledge-party, under Commander Aldrich, found the same heavy ice extending along the coast of Grant Land. They were also attacked by the scurvy, Commander Aldrich being the only one who escaped, and relief fortunately reached them the last day that most of them were able to travel.

Commander Aldrich explored a line of coast for two hundred and thirty miles west of the spot where the Alert wintered, — ninety miles of which trends northwesterly to Cape Columbia, the name given to the extreme northern cape, $83^{\circ} 7' \text{ N. lat.}, 70^{\circ} 30' \text{ W. long.}$; thence westward for sixty miles to $79^{\circ} \text{ W. long.}$, and from there gradually south to $82^{\circ} 16' \text{ N. lat.}$ and $84^{\circ} 33' \text{ W. long.}$, with no indication of land extending from there either westward or northward.

Commander Beaumont, with his sledge-party, traced the north-west and northern coast of Greenland from Polaris Bay to a point east of what has been called Mount May, in $82^{\circ} 40' \text{ N. lat.}, 50^{\circ} 40' \text{ W. long.}$, where he sighted the farthest northern land seen in the expedition in $82^{\circ} 54' \text{ N. lat.}$ and $48^{\circ} 33' \text{ W. long.}$ (Cape Britannia and Mount Albert), and found that the Greenland coast runs from Mount May, in a southeasterly direction, to below the eighty-second parallel of north latitude; whilst Lieutenant Archer explored Lady Franklin's Bay, and Lieutenant Fulford and Dr. Copping, Peterman's Fiord and its vicinity.

The result of these expeditions has been that the coast of Grant Land has been explored from Robeson's Channel westward for a distance of about two hundred and fifty miles, leaving about four hundred miles unknown, between Aldrich's farthest point west and the nearest known land, Ireland's Eye. The north coast of Greenland has been discovered for about one hundred miles, leaving unknown five hundred miles, from Beaumont's farthest to the farthest point ascertained by the expedition of Koldewey, Cape Bismark, on the east coast of Greenland, — the entire exploration east and west extending over thirty-eight degrees of longitude. All this was accomplished against the most formidable

obstacles and under circumstances about as trying as have ever fallen to the lot of Arctic discoverers. The patience, cheerfulness, courage, and perseverance displayed alike by officers and men in accomplishing the work of these expeditions entitle them to the unqualified praise of the entire geographical world.

In addition to these labors the western coast of Smith Sound was surveyed and accurately delineated to the Polar Sea. The ice-formation upon the shores of what Sir George Nares has denominated the *Palæocrystic Sea* were carefully studied. The evidence of the luxuriant vegetation which is now known to have existed in the Arctic regions in a past period of the world's history has been traced as high up as the eighty-second parallel of north latitude,—a deposit of coal, equal to that of Wales, having been found three miles from where the *Discovery* wintered, with the impression of leaves on the overlying shale. The meteorological observations were extensive and valuable, and a very complete series of magnetic observations were taken at the two stations. A very full collection of plants has been made, and the zoölogy of the region has been thoroughly investigated; the distribution of animal life upon the land and in the water has been carefully studied, and crustaceans have been brought up from a depth of seventy fathoms, at the farthest northern point reached by Markham.

By the geographer and man of science the voyage will be pronounced a most important and successful one. Mr. Clements L. Markham, the editor of the "Geographical Magazine," declares it to be the most successful Arctic expedition that ever left the shores of England, achieving, he says, an amount of valuable work such as has never been equalled, in face of the appalling hardships and difficulties that were encountered. On the other hand, it has been severely criticised both in England and in this country. The complaint made is, that, in view of the perfection of its outfit, and the great expense incurred, it did not accomplish more; that it did not remain, in accordance with the orders given by the Admiralty, until the end of another year; that the outbreak of the scurvy and the great extent of it was owing to a neglect of the ordinary preventives, especially upon the sledge expeditions, and that the most judicious method of sledging was not adopted. Much of this fault-finding, so far as it has fallen under our ob-

ervation, has been by writers whose productions show that they have but a very limited acquaintance with what is known respecting the Arctic,—a remark not meant to apply to Dr. Hayes, Dr. Rae, and others, of Arctic experience. A leading English journal, the “Saturday Review,” went so far as to declare that the principal officers in command had no heart in the work; that they went because they were appointed, and returned as speedily as they could. To us, on this side of the Atlantic, this appears to be exceedingly unjust. Judging only by what is known to the world, but little, if anything, more could have been accomplished by remaining another year with crews disabled by scurvy. The results of the extensive Russian expeditions, and of many others, show that there is a limit as to the time within which men can be kept in the Arctic. The effect of great cold is very depressing in its influence, for, though stimulating at first, it gradually lessens the muscular action, enfeebles the power of the will, and produces depression, languor, and a desire for rest; so that two years, at the farthest, is the limit to which men can be usefully employed in the Arctic. Attacked as extensively as the crews were in this voyage by scurvy, they would, had they remained, have been incapable of hard labor, and the wise and true course, therefore, was to return at the first available opportunity. Sir George Nares’s decision in this respect has been approved by the Admiralty, and will be approved by all who are familiar with the history of Arctic exploration.

We have little to say upon the subject of scurvy. It has broken out where lime-juice was used and where every other precaution possible was taken; whilst there have been extensive sledge-expeditions, where no lime-juice at all was used, that were wholly free from it. As respects the sledging, the whole arrangement for it was devised before the vessels left England, by Sir Leopold McClintock, who has had more experience in sledge-travelling than any living Arctic explorer, and Sir George Nares, who carried it out, had himself great experience in this mode of travelling in the expeditions of the *Resolute* and the *Intrepid*, 1852–53. It is also to be borne in mind that the expeditions around Grant Land and Greenland found the sea along the coast covered with broken-up masses of ice of immense thickness unlike anything hitherto seen in the Arctic, except by McClure, Collinson,

and Meacham off Banks and Prince Patrick's Islands, and we have already pointed out what the party had to encounter that attempted to reach the Pole.

Sir George Nares, in a very able paper read before the Royal Geographical Society, has given his views of the condition of the Polar Ocean, with the conclusion that all further attempts by the way of Smith Sound are useless, and that the region between Spitzbergen and Franz Joseph's Land has now become the most interesting neighborhood for exploration; with which Dr. Peterman, the eminent geographer of Gotha, concurs. Sir George is of opinion that Greenland does not extend much farther north than the latitude to which Beaumont traced it. He is certain that they were on the borders of a large sea, which is covered by ice during winter. Whether it extends to or across the Pole he does not assume to determine, but thinks that it may safely be predicted that a very broad opening or large sea exists from Cape Columbia, the farthest northern point of Grant Land; and this opening or sea he believes extends as far as the Pole. In the summer, he says, there is a thaw over the whole Arctic Sea; the ice breaks up, and is subject to motion from the winds and currents; about the first week in July the whole of the pack begins to drive backwards and forwards, according to the wind and current,—its main course being to the outlets, through which it escapes from the Polar Basin in small quantities, and this state of things continues until the end of September, when the increasing frost cements the contending masses of ice, and by the end of October the whole Polar Sea is again frozen, breaking only occasionally with the tidal currents. He further states, that, as there is a constant formation of ice during seven months of the year, it more than equals the melting or decay during the other five months; and that, allowing that it moves when escaping through the outlets at the rate of four miles a day during the three or four months of summer, there would be from one half to two thirds of the whole quantity constantly remaining in the Polar Basin; that from this state of facts there is a great accumulation, in the Arctic, of ancient ice,—ice, Sir George says, one hundred years old, forced up, as they found it; of enormous thickness and height along the shores of the Polar Sea, which he distinguishes by a newly devised term, *Palæocrystic*.

This opinion of the physical condition of the inner Polar Basin is entitled to weight, coming as it does from a previous Arctic explorer, who knows the difference between old and new ice, and who, having upon this occasion spent eleven months in studying the formation heaped up along the coast of Grant Land, must have been able to form a tolerable judgment respecting its age. Whatever quantity of land, he says, may yet be discovered, it may safely be assumed that the area of the Polar Sea embraces from a million to a million and a half of square miles, its principal outlet between Spitzbergen and Greenland being little more than three hundred miles broad.

If this, then, be the true condition of the region around the Pole, it affords no support to the theory of an open Polar Sea,—the conclusion to be arrived at being that there is a large Polar Sea, but that it is not an open one; that, on the contrary, it is frozen over for seven months in the year; and that during the few months of the summer its condition is such as to render navigation exceedingly perilous, if not impossible. The belief in this supposed open sea, which has prevailed more or less for three centuries, we have never been able to trace to its source. In Jacob Ruysch's map of the world, prefixed to the edition of Ptolemy, of 1508, an open Polar Sea is represented with a rock in the middle of it. When the mariner's compass came into use in Europe, about the twelfth century, the belief arose that the attraction to which the needle yielded was a huge magnetic rock, situated at the Pole. Ruysch, in an inscription on his map, says, upon the information of a work to which he refers ("The Discovery of Fortunatus"), that there is, at the North Pole, a large rock, of thirty-three German miles in circumference, surrounded by a sea into which rivers flow; and that there are islands around this sea, with high mountains, two of the islands being inhabited. A century afterwards, Plancius, a Dutch theologian and geographer of the sixteenth century, drew attention to the existence of this sea, as a route by which to reach the Indies; and when Mercator published his map of the world, in 1569, although he omitted this sea in the general map, he represented it upon the same sheet by a separate map, with a large island in the centre, and four rivers flowing into it from the four opposite points.

In Mercator's Atlas by Hondius, Mercator's drawing or map of

this imaginary sea is said to have been made from a description of it in the Itinerary of Jacob Cnoyen of Bolduck, who, it is said, derived his information in part from the "*Res Gestæ*" of Arthur of Britain, and in part from a priest of the King of Norway, who said that an English monk from Oxford had visited the islands of this sea in 1364, and measured them with the astrolabe. In the imperfect state of geographical knowledge at that time, such information as this was regarded as reliable, and stories were current in Holland in the seventeenth and eighteenth centuries, that Dutch fishermen had sailed into this open sea without any obstruction as far as the Pole. These stories continuing to be circulated, and being published in geographical works, both in Holland and in other countries, Professor Allman, of Leyden, determined in 1773 to ascertain by investigation how far north Dutch fishermen had reached, and Captain May, an officer in the Dutch service, together with Van Keulin, the eminent Dutch cartographer, made a thorough investigation, which was carried on chiefly at the Helder, where most of the Dutch fishermen lived, and where these expeditions were fitted out. Information was sought from the oldest shipmasters and from those mariners who had made the greatest number of voyages. Journals were inspected, old maps and charts examined, and every available source of information was ransacked. The result of this inquiry was that the Dutch vessels had generally succeeded in getting as far as 81° N. lat., and that the most northern voyage ever heard of at the Helder was that of one John Schol in 1700, who, according to his reckoning, had reached as far as 84° N. lat., which cannot be implicitly relied on, as inaccuracy in latitudes was then common, Hadley's quadrant not having been invented until 1730. Daines Barrington, in 1775, published in a volume a full account of all the loose and hearsay information which had accumulated with the result of Professor Allman's exhaustive investigation in Holland, to which Colonel Beaufoy added an appendix in 1818, and nothing more was heard of the open Polar Sea until Captain Maury, it would seem, revived it, about the year 1850. Maury acquired, especially in England, a great reputation by the hydrographic observations, worked out by a much greater man, the grandson of Benjamin Franklin, Dr. A. D. Bache, for many years the head of our Coast Survey, which Maury in his publications made use of and which the world

accepted as his own. With the reputation thus acquired as an hydrographer, his advocacy of the theory of an open Polar Sea gave it a certain weight. Attracted by Dr. Bache's investigations upon the observations of the course of the Gulf Stream taken in our Coast Survey, Maury, a man of active imagination and wholly wanting in those essentials requisite in a geographer, — care, caution, and accuracy, — at once leaped to the conclusion that the warm waters of the Gulf Stream penetrated as an undercurrent into the Polar Basin, whilst a cold surface-current passed out through Davis Straits, and that this warm current of the Gulf Stream, rising to the surface at the Pole, or its vicinity, modified the climate there, and was adequate to produce and maintain an open sea "teeming with animal life." In Maury's imaginative language, "the extra-tropical regions of the northern hemisphere acted as a condenser to a grand steam-machine, the boiler of which was in the region of the southeast trade-winds."

The effect which the Gulf Stream does produce in modifying the climate along the northern coast of Norway, and as far as Nova Zembla, together with the existence of polynias * of open water, which had been seen by explorers in other parts of the Arctic, led him to another loose generalization, that the belt of extreme cold was south of 80° N. lat., and that beyond this to the north a milder climate existed, to which the birds seen flying to the north, in Polar expeditions, resorted, and through the seas of which those whales found their way that were struck with harpoons in the Pacific and were afterwards found in the Atlantic with the same harpoons in them. The water sky seen by De Haven in Wellington Channel, and the polynia or open water afterwards found by Captain Penny in the same vicinity, were to Maury convincing proof of the existence of an open sea to the north, not always, he said, in the same place, as the Gulf Stream is not always in the same place, but to be found wherever the warm water in the Polar area rises to the surface. Here the existence of the warm current of the Gulf Stream in the interior Polar Basin was taken for granted, of which there was not then, nor has there ever been since, the slightest evidence. In the Austrian expedition to Franz Joseph Land in 1872–73 no proofs of its existence in that direction north were discovered, and the very last observa-

* A name given by the Russians to a supposed iceless sea around the Pole. — ED.

tions indicate that its farthest prolonged course is easterly, through the Kara Straits, into the Kara Sea, with a greatly diminished volume.

The flowing of this warm current into the interior of the Arctic being thus assumed as a basis, it was easy to build a plausible structure upon it, and, Maury being a very attractive writer, a general impression was produced that this large open sea existed.

It will illustrate the imaginative character of Maury in geographical matters to state that he had a like conception respecting the Antarctic. In 1858 he addressed a long communication to the American Geographical Society in exposition of a vague theory he had formed that the winds did not blow across the interior of the Antarctic but moved in a circle around that region, producing by the congelation of their moisture the circle of ice-barriers by which it is known to be surrounded, in which communication he claimed that when these barriers were crossed a region would be found within, capable of sustaining animal and vegetable life, and which was probably inhabited by man, — proposing that the society should petition Congress to send out an expedition to prove the truth of this hypothesis, which the society declined to do.

Dr. Kane, after his return from the first Grinnell Expedition, in 1851, impressed by the high reputation which Maury then had as an hydrographer, embraced this theory with his characteristic ardor. He rejected as unworthy of credit the stories of Dutch fishermen having sailed through this open sea to the Pole, but adopted Maury's general views. This open sea, he said, "is generally recognized to exist, not upon the result of explorations, but rather upon the well-elaborated deductions of Sabine and Berghaus, and especially of our accomplished hydrographer, Lieutenant Maury," and he embodied his own and Maury's views in an able and eloquent paper which he read before the American Geographical Society in 1852. We were present at the reading of this paper, and our impression was then, and has been ever since, that in ignorance of the physical condition of the interior of the Polar Basin, the rational presumption would be that the state of cold which is found around the Polar Circle as far as it has been penetrated would not be diminished but rather increased, farther north, as the length of the winter or long

polar night increases towards the Pole. Dr. Kane, however, did not think so. His object, in his expedition in 1853-55 was, in addition to searching for Sir John Franklin, to find his way into this open Polar Sea; and when Morton, in June, 1854, at 81° 22' N. lat., saw open water with the waves wildly dashing against the shore in what we now know to be Hall's Basin, at the end of Kennedy Channel, Kane sincerely believed that his associate was upon the shores of this great open Polar Sea, and even so cautious a scientific reasoner as Dr. Bache was convinced after Kane's return that he had found such a sea.

Dr. Hayes, who accompanied Kane in this expedition, and went upon an expedition of his own in the same direction in 1860, in the schooner *United States*, thought then, and thinks still, that this sea exists. In justice to Dr. Hayes, his view should be given in his own words. He holds that the Gulf Stream flows northward, "pouring the warm waters of the Tropic Zone through the broad gateway east of Spitzbergen, forcing out a return-current of cold water to the west of Spitzbergen and through Davis Straits," and that "this displacement of the waters of the Pole by the waters of the Equator . . . tempers the whole Arctic region with a warmth above that which is otherwise natural to it." His further argument is that, as "the ceaseless currents of the sea and the tide-flow of the surface" there "keep the waters ever in movement, it is not possible that any considerable portion of this sea can be frozen over"; that "the sea does not close except when at rest; and that "at no point in the Arctic Circle has there been found an ice-belt extending, either in winter or in summer, more than from fifty to one hundred miles from land."

Scoresby maintained, long ago, that the sea in the Arctic will freeze over. The point has been disputed and discussed for a great length of time, but it may be stated, upon the authority of Payer, that that discussion is now at an end, the prevailing opinion being that it will freeze.

Great respect is due, by writers who have not been themselves in the Arctic regions, to the views of a man of the ability and Arctic experience of Dr. Hayes, especially as like views were entertained by two eminent English Arctic explorers, Sir Edward Belcher and Admiral Inglefield; but, as against their united judgment, it

should be stated that many of the most distinguished Arctic explorers have never believed in the existence of this open sea, among whom may be named Hudson, Baffin, Phipps, Scoresby, Buchan, Franklin, Parry, Collinson, Hamilton, McClintock, and, among recent explorers, Koldeway, Nordenskjöld, Weyprecht, Payer, and Nares. Payer, at the farthest point reached in Franz Joseph Land, $82^{\circ} 5' \text{ N. lat.}$, saw open water of a considerable extent. He was able, from a height, to survey its extent, and found that it was not an open sea, but a polynia, *surrounded by old ice*, within which lay masses of young ice. In the Austrian and the English expeditions, which from different points reached nearer the Pole than any others, it was found that animal and vegetable life steadily decreased as they got farther north. Franz Joseph Land was pronounced the most desolate land upon earth, and the northern region explored in the English expedition was of the same general character. The result of both of these last expeditions is, therefore, not only unfavorable to the existence of this supposed open Polar Sea, but their experience shows that the difficulty of reaching the Pole, even by sledging, is greatly beyond what it was supposed to be, unless a coast-line should be discovered trending in the direction of the Pole.

The conclusion of Sir George Nares, that any further attempt in Smith Sound is useless, will not be accepted by American geographers. Unexplored land exists northeast of the farthest point reached by Beaumont in Greenland, and though Sir George thinks that the land thus seen is about the northern limit of Greenland, Dr. Peterman, on the contrary, maintains that Greenland probably extends to and across the Pole. From what is now known, further explorations can be carried on as well by the way of Smith Sound as in any other direction, and in that view Captain Howgate, of the United States Signal Service has advocated the establishment of a station in Smith Sound, as a base from which explorations may be directed as favorable opportunities offer, and a bill is now before Congress to carry out this plan.

The question is frequently asked, "What is the use of continuing these Polar expeditions, now that the existence of a northwest passage is ascertained, and that it is of no practical value for commerce?" The answer is, that there is no portion of the earth's surface where exploration for scientific purposes is of so much

value as in the region of the Arctic. It has been penetrated much farther than the Antarctic, and can be penetrated still farther, whilst the Antarctic is so walled around with great ice-barriers as to make the task there exceedingly difficult, if not hopeless. We have extended the limits of this article so far that we cannot enter upon this question at length. It will suffice to say that the late Admiral Sherard Osborn gave a full enumeration of the many important scientific subjects to be elucidated by investigation in the Arctic area; Mr. Alex. von Humboldt van der Hoerck set forth the scientific reasons very lucidly, a short time ago, in a paper read by him before the American Geographical Society; and Professor Loomis of Yale College in a recent letter to Captain Howgate has stated the general reasons so concisely that we will give them in his own words:—

“There is scarcely a problem relating to the physics of the globe which can be fully understood without a knowledge of the phenomena within the polar regions. Whatever phenomena we may wish to investigate, it is of special importance to determine its maximum and minimum values, and in nearly all questions of terrestrial physics one or other of these values is found in the neighborhood of the Pole. If, for example, we wish to determine the distribution of temperature upon the surface of the globe, it is specially important to determine the extremes of temperature, one of which is to be found near the Equator, and the other near the Poles. If we wish to investigate the system of circulation of the winds, our investigation would be sadly deficient without a knowledge of the phenomena in the polar regions. If we wish to study the fluctuations in the pressure of the atmosphere, whether periodical or accidental, we cannot be sure that we understand the phenomena in the middle latitudes unless we know what takes place in the polar regions. If we wish to investigate the currents of the ocean, we find indications of currents coming from the polar regions, and it is important to be able to trace these currents to their source. If we wish to investigate the laws of the tides, we need observations from every ocean; and observations in the Arctic regions have a special value, on account of their distance from the place where the daily tidal wave takes its origin. If we wish to study the phenomena of atmospheric electricity and of auroral exhibitions, no part of the world is more important than the polar regions. If we wish to study the phenomena of terrestrial magnetism, observations in the polar regions have a special value, since it is here the dipping needle assumes a vertical position, and the in-

tensity of the earth's magnetism is the greatest. If we wish to determine the dimensions and figure of the earth, we require to know the length of a degree of latitude where it is greatest, and also where it is least. If we wish to determine how the force of gravity varies in different parts of the world, we require observations of the seconds' pendulum, both where it is the greatest and where it is the least. In short, there is no problem connected with the physics of the globe which does not demand observations from the polar regions; and generally the Poles and the Equator are more important as stations of observation than any other portions of the earth's surface. If the information which has been acquired upon these various subjects in the numerous polar expeditions of the last half-century were annihilated, it would leave an immense chasm."

In closing, we call attention to a statement of Sir George Nares, that Kane and Hayes changed the names which had been given by Admiral Inglefield to headlands in Smith Sound, and that both published very misleading delineations of the coast. As this is the only reference made to these two previous American explorers in the same field, and is and was meant to be severe in its condemnation of them, it would naturally be expected that some facts would have been stated to justify it. If Sir George Nares considered it necessary to introduce such a subject in an account of his own expedition, it should not have been by a general charge in this form, but the facts should have been set forth upon which it is founded. It is even incumbent upon him now to do so, as Dr. Hayes has, as respects himself, denied the charge through the public journals, and Dr. Kane is dead.

CHARLES P. DALY.

THE ARCTIC REGIONS



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